

In the Claims:

1. (Previously Presented) An asymmetrical key cryptography method involving a keyholder having a number $m \geq 1$ of private keys Q_1, Q_2, \dots, Q_m and respective public keys G_1, G_2, \dots, G_m , each pair of keys (Q_i, G_i) (where $i = 1, \dots, m$) satisfying either the relationship $G_i = Q_i^v \bmod n$ or the relationship $G_i \times Q_i^v = 1 \bmod n$, where n is a public integer equal to the product of f (where $f > 1$) private prime factors p_1, \dots, p_f , at least two of which are separate, and the exponent v is a public integer equal to a power of 2, wherein the method comprises the steps of:

arranging exponent v to have the relationship $v = 2^{b+k}$,
where k is a strictly positive integer and $b = \max(b_1, \dots, b_f)$, where b_j (where $j = 1, \dots, f$) is the highest integer such that $(p_j - 1)/2^{b_j-1}$ is even; [[,]] and

arranging each public key G_i (where $i = 1, \dots, m$) to have the form $G_i = g_i^{2^{a_i}} \bmod n$,
where the base numbers g_i are integers strictly greater than 1 and the numbers a_i are integers such that $1 \leq a_i \leq b$ and at least one of them is strictly greater than 1.

2. (Previously Presented) A method according to claim 1, wherein at least one of said prime factors p_1, \dots, p_f is congruent to 1 modulo 4 and the integers a_i (where $i = 1, \dots, m$) are all equal to said number b .

3. (Previously Presented) A method according to claim 1, wherein said base numbers g_1, \dots, g_m include at least one number g_s and said prime factors p_1, \dots, p_f include at least two numbers p_t and p_u other than 2 such that, given said numbers b_1, \dots, b_f ,

if $b_t = b_u$, then $(g_s | p_t) = - (g_s | p_u)$, and

if $b_t < b_u$, then $(g_s | p_u) = -1$,

where $(g_s | p_t)$ and $(g_s | p_u)$ denote the Legendre symbols of g_s relative to p_t and p_u .

4. (Previously Presented) A method according to claim 1, wherein the base numbers g_1, \dots, g_m are prime numbers.

5. (Previously Presented) A method according to claim 1, involving a controller and said keyholder, here called the claimant, wherein the method comprises the following steps:

the claimant chooses at random an integer r , calculates the witness $R = r^v \bmod n$ and sends the witness to the controller,

the controller chooses at random m challenges d_1, d_2, \dots, d_m and sends the challenges to the claimant,

the claimant calculates the response

$$D = r \times Q_1^{d_1} \times Q_2^{d_2} \times \dots \times Q_m^{d_m} \bmod n,$$

and sends the response to the controller, and

the controller calculates

$$D^v \times G_1^{\varepsilon_1 d_1} \times G_2^{\varepsilon_2 d_2} \times \dots \times G_m^{\varepsilon_m d_m} \bmod n$$

where, for $i = 1, \dots, m$, $\varepsilon_i = +1$ if $G_i \times Q_i^v = 1 \bmod n$ and $\varepsilon_i = -1$ if $G_i = Q_i^v \bmod n$,

and verifies that the result is equal to the witness R .

6. (Currently Amended) A method according to claim 1, enabling a controller to verify that a message M that it has received was sent to it by said keyholder, here called the claimant, wherein the method comprises the following steps:

the claimant chooses at random an integer r and first calculates the witness $R = r^v \bmod n$, then calculates the token $T = h(M, R)$, where h is a hashing function, and finally sends the token T to the controller,

the controller chooses at random m challenges d_1, d_2, \dots, d_m ~~where $i = 1, \dots, m$~~ , and sends the challenges to the claimant,

the claimant calculates the response

$$D = r \times Q_1^{d_1} \times Q_2^{d_2} \times \dots \times Q_m^{d_m} \bmod n \text{ and sends the response to the controller, and}$$

the controller calculates $h\left(M, D^v \times G_1^{\varepsilon_1 d_1} \times G_2^{\varepsilon_2 d_2} \times \dots \times G_m^{\varepsilon_m d_m} \bmod n\right)$ where, for $i = 1, \dots, m$, $\varepsilon_i = +1$ if $G_i \times Q_i^v = 1 \bmod n$ and $\varepsilon_i = -1$ if $G_i = Q_i^v \bmod n$, and verifies that the result is equal to the token T .

7. (Previously presented) A method according to claim 5, wherein the challenges satisfy the condition $0 \leq d_i \leq 2^k - 1$ for $i = 1, \dots, m$.

8. (Currently Amended) A method according to claim 1, enabling said keyholder, here called the signatory, to sign a message M that it sends to a controller, wherein the method comprises the following steps:

the signatory chooses at random m integers r_i , where $i = 1, \dots, m$, and first calculates the witnesses $R_i = r_i^v \bmod n$ ~~$R = r^v \bmod n$~~ , then calculates the token $T = h(M, R_1, R_2, \dots, R_m)$, where h is a hashing function producing a word of m bits, and finally sends the token T to the controller,

the signatory identifies the bits d_1, d_2, \dots, d_m of the token T ,

the signatory calculates the responses $D_i = r_i \times Q_i^{d_i} \bmod n$ and sends the responses to the controller, and

the controller calculates

$$h \left(M, D_1^v \times G_1^{\varepsilon_1 d_1} \bmod n, D_2^v \times G_2^{\varepsilon_2 d_2} \bmod n, \dots, D_m^v \times G_m^{\varepsilon_m d_m} \bmod n \right)$$

where, for $i = 1, \dots, m$, $\varepsilon_i = +1$ if $G_i \times Q_i^v = 1 \bmod n$ and $\varepsilon_i = -1$ if $G_i = Q_i^v \bmod n$, and verifies that the result is equal to the token T .

9. (Currently Amended) An electronic circuit including a processor and memories, wherein the electronic circuit ~~can be~~ is programmed to act as said keyholder in executing a method according to claim 1.

10. (Previously Presented) A dedicated electronic circuit, including microcomponents enabling the electronic circuit to process data in such manner as to act as said keyholder in executing a method according to claim 1.

11. (Currently Amended) A portable object adapted to be connected to a terminal to exchange data with that terminal, wherein the portable object includes an electronic circuit according to claim 9 or claim 10 and is adapted to store identification data and private keys specific to said key holder.

12. (Currently Amended) A terminal adapted to be connected to a portable object to exchange data with that portable object, wherein the terminal includes a data processing device programmed to act as said controller in executing a method according to ~~claim 1~~ any one of claims 5-8.

13. (Currently Amended) A cryptography system comprising:
a portable object adapted to be connected to a terminal to exchange data with that terminal, wherein the portable object includes an electronic circuit ~~having a processor and memories,~~

wherein the electronic circuit ~~can be~~ is programmed to act as said keyholder in executing ~~a method according to claim 1~~ an asymmetrical key cryptography method involving a keyholder having a number $m \geq 1$ of private keys Q_1, Q_2, \dots, Q_m and respective public keys G_1, G_2, \dots, G_m , each pair of keys (Q_i, G_i) (where $i = 1, \dots, m$) satisfying either the relationship $G_i = Q_i^v \text{ mod } n$ or

the relationship $G_i \times Q_i^v = 1 \bmod n$, where n is a public integer equal to the product of f (where $f > 1$) private prime factors p_1, \dots, p_f , at least two of which are separate, and the exponent v is a public integer equal to a power of 2, wherein the method comprises the steps of:

arranging exponent v to have the relationship $v = 2^{b+k}$,

where k is a strictly positive integer and $b = \max(b_1, \dots, b_f)$, where b_j (where $j = 1, \dots, f$) is the highest integer such that $(p_j - 1) / 2^{b_j - 1}$ is even; [[,]] and

arranging each public key G_i (where $i = 1, \dots, m$) to have the form

$$\underline{G_i = g_i^{2^{a_i}} \bmod n,}$$

where the base numbers g_i are integers strictly greater than 1 and the numbers a_i are integers such that $1 \leq a_i \leq b$ and at least one of them is strictly greater than 1,

and wherein the portable object is adapted to store identification data and private keys specific to said key holder; and

a terminal adapted to be connected to the portable object to exchange data with that portable object, wherein the terminal includes a data processing device programmed to act as said controller in executing a method according to [claim 1] any one of claims 5-8.

14. (Currently Amended) Non-removable data storage means containing electronic data processing program code instructions for, as said keyholder, executing the steps of ~~any of the methods of~~ a method according to claim 1.

15. (Previously Presented) Partially or totally removable storage means containing electronic data processing program code instructions for, as said keyholder, executing the steps of a method according to claim 1.

16. (Currently Amended) A data processing device comprising storage means according to claim 14 or claim 15.

17. (Currently Amended) Non-removable data storage means containing electronic data processing program code instructions for, as said controller, executing the steps of ~~any of the methods of~~ a method according to ~~claim 1~~ any one of claims 5-8.

18. (Currently Amended) Partially or totally removable data storage means containing electronic data processing program code instructions for, as said controller, executing the steps of a method according to ~~claim 1~~ any one of claims 5-8.

19. (Currently Amended) A data processing device, wherein it comprises storage means according to claim 17 or claim 18.

20. (Currently Amended) A cryptography system comprising:
a data processing device including ~~non-removable~~ storage means containing electronic data processing program code instructions for, as said keyholder, executing the steps of ~~any of the methods of a method according to claim 1~~ an asymmetrical key cryptography

method involving a keyholder having a number $m \geq 1$ of private keys Q_1, Q_2, \dots, Q_m and respective public keys G_1, G_2, \dots, G_m , each pair of keys (Q_i, G_i) (where $i = 1, \dots, m$) satisfying either the relationship $G_i = Q_i^v \bmod n$ or the relationship $G_i \times Q_i^v = 1 \bmod n$, where n is a public integer equal to the product of f (where $f > 1$) private prime factors p_1, \dots, p_f , at least two of which are separate, and the exponent v is a public integer equal to a power of 2, wherein the method comprises the steps of:

arranging exponent v to have the relationship $v = 2^{b+k}$,

where k is a strictly positive integer and $b = \max(b_1, \dots, b_f)$, where b_j (where $j = 1, \dots, f$) is the highest integer such that $(p_j - 1)/2^{b_j-1}$ is even; [[,]] and

arranging each public key G_i (where $i = 1, \dots, m$) to have the form

$$\underline{G_i = g_i^{2^{a_i}} \bmod n,}$$

where the base numbers g_i are integers strictly greater than 1 and the numbers a_i are integers such that $1 \leq a_i \leq b$ and at least one of them is strictly greater than 1; and

a data processing device including ~~non-removable~~ data storage means containing electronic data processing program code instructions for, as said controller, executing the steps of ~~any of the methods of~~ a method according to ~~claim 1~~ any one of claims 5-8.

21. (Previously Presented) A computer program containing instructions such that, when said program controls a programmable data processing device, said instructions cause said data processing device to execute a method according to claim 1.

22. (Previously Presented) A method according to claim 4, wherein the base numbers g_1, \dots, g_m are chosen from the first 54 prime numbers.